equation of the fifth order was kindly performed for me by the Rev. R. Harley. It is to be noticed that the best course is to apply the method in the first instance to the forms $(a, b, \ldots \between v, 1)^n=0$, without numerical coefficients (or, as they may be termed, the *denumerate forms*), and to pass from the results so obtained to those which belong to the forms $(a, b, \ldots \between v, 1)^n=0$, or *standard forms.* The equation of differences, for $(\alpha-\beta)^2$, &c., the coefficients of which are seminvariants, naturally leads to the consideration of a more general equation for $(\alpha-\beta)^2\ (x-\gamma y)^2\ (x-\delta y)^2$, &c., the coefficients of which are covariants; and in fact, when, as for equations of the orders two, three, and four, all the covariants are known, such covariant equation can be at once formed from the equation of differences; for equations of the fifth order, however, where the covariants are not calculated beyond a certain degree, only a few of the coefficients of the covariant equation are given. At the conclusion of the memoir, I show how the equation of differences for an equation of the order n can be obtained by the elimination of a single quantity from two equations each of the order $n-1$; and by applying to these two equations the simplification which I have made in Bezout's abridged method of elimination, I exhibit the equation of differences for the given equation of the order n, in a compendious form by means of a determinant; the method just employed is, however, that which is best adapted for the actual development of the equation of differences for the equation of a given order.

III. "On the Theory of Elliptic Motion." By Arthur Cayley, Esq., F.R.S. Received March 9, 1860.

The present Note is intended to give an account of the results which, by means of a grant from the Donation Fund of the Royal Society, I have procured to be calculated for me by Messrs. Creedy and Davis, and which are contained in a memoir presented to the Royal Astronomical Society, entitled "Tables of the Developments of Functions in the Theory of Elliptic Motion." The notation employed is

r, the radius vector;
f, the true anomaly;
a, the mean distance;
e, the excentricity;
g, the mean anomaly;

so that $\frac{r}{a}, = elqr(e, g),$

and $f, = elta(e, g)$

(read elliptic quotient radius and elliptic true anomaly), are known functions of e, g. Moreover x denotes the periodic part of $\frac{r}{a}$, and y the equation of the centre or periodic part of f; so that

$$\frac{r}{a} = 1 + x,$$

$$f = g + y,$$

and x, y are also known functions of e, g.

Formulæ for the development in multiple cosines or sines up to the terms in e^7 of

$$(x^0, x^1 \ . \ . \ . \ x^7) {\cos \atop \sin} jy,$$

where j is an indeterminate symbol, are given by Leverrier in the 'Annales de l'Observatoire de Paris,' t. i. (1855), pp. 346–348; and what has been done is the deduction from these of the developments in the like form of various functions of the forms

$$x^m {\cos \atop \sin} jf \left(\frac{r}{a}\right)^{\pm m} {\cos \atop \sin} jf,$$

where j has given integer values. It is to be remarked that a cosine series is in general represented in the form $\Sigma\, [\cos]^i \cos ig$, where i extends from $-\infty$ to $+\infty$, and the coefficients $[\cos]^i$ satisfy the condition $[\cos]^{-i} = -[\cos]^i$, and that a sine series is represented in the form $\Sigma\, [\sin]^i \sin ig$, where i extends from $-\infty$ to $+\infty$, and the coefficients $[\sin]^i$ satisfy the condition $[\sin]^{-i} = -[\sin]^i$ (this implies $[\sin]^0 = 0$). In the case of a pair of corresponding functions, $x^m \cos jf$ and $x^m \sin jf$, or $\left(\frac{r}{a}\right)^{\pm m} \cos jf$ and $\left(\frac{r}{a}\right)^{\pm m} \sin jf$, one of them expanded in the form $\Sigma\, [\cos]^i \cos ig$, and the other in the form $\Sigma\, [\sin]^i \sin ig$, the sums and differences of the corresponding coefficients $[\cos]^i$, $[\sin]^i$ (represented by the notation $[\cos \pm \sin]^i$, and which are obviously such that $[\cos + \sin]^{-i} = [\cos - \sin]^i$, $[\cos \pm \sin]^0 = [\cos]^0$) are for many purposes equally useful with the coefficients $[\cos]^i$, $[\sin]^i$, and they are in the memoir tabulated accordingly; and the several functions tabulated are as follows: viz.

$$(x^1, x^2 \ldots x^7) \qquad , [\cos]$$

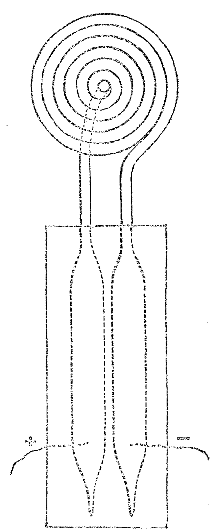
$$(x^0, x^1, x^2 \ldots x^7) \begin{matrix}\cos\\ \sin\end{matrix} jf, j=1 \text{ to } j=7, [\cos], [\sin], [\cos \pm \sin]$$

$$\left(\left(\frac{r}{a}\right)^{+4} \ldots \left(\frac{r}{a}\right)^{+1}, \log\frac{r}{a}, \left(\frac{r}{a}\right)^{-1} \ldots \left(\frac{r}{a}\right)^{-5}\right) \qquad , [\cos]$$

$$\left(\left(\frac{r}{a}\right)^{+4} \ldots \left(\frac{r}{a}\right)^{+1} \quad \left(\frac{r}{a}\right)^{-1} \ldots \left(\frac{r}{a}\right)^{-5}\right) \begin{matrix}\cos\\ \sin\end{matrix} jf, j=1 \text{ to } j=5, [\cos], [\sin], [\cos \pm \sin]$$

all the developments being carried up to e^7, the limit of the formulæ from which they are deduced.

IV. "On the Application of Electrical Discharges from the Induction Coil to the purposes of Illumination." By J. P. Gassiot, Esq., F.R.S. Received March 29, 1860.



The subjoined figure represents a carbonic acid vacuum-tube of about $\frac{1}{16}$ of an inch internal diameter, wound in the form of a flattened spiral. The wider ends of the tube, in which the platinum wires are sealed, are 2 inches in length and about $\frac{1}{2}$ an inch in diameter, and are shown by the dotted lines; they are enclosed in a wooden case (indicated by the surrounding entire line), so as to permit only the spiral to be exposed.

When the discharge from a Ruhmkorff's induction apparatus is passed through the vacuum-tube, the spiral becomes intensely luminous, exhibiting a brilliant white light. Mr. Gassiot, who exhibited the experiment at the meeting of the Society, caused the discharge from the induction coil to pass through two miles of copper wire; with the same coil excited so as to give a spark through air of one inch in length, he ascertained that the luminosity in the spiral was not reduced when the discharge passed through 14 miles of No. 32 copper wire.